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Division of Science and Research
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Water Monitoring Management

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SANITARY SURVEY

SHELLFISH GROWING AREA SE-5

GREAT SOUND, HEREFORD INLET, JENKINS SOUND,
GRASSY SOUND & RICHARDSON SOUND

1995 - 1998

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New Jersey Department of Environmental Protection
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EXECUTIVE SUMMARY

The water quality data presented in this Sanitary Survey was collected between January 1995, and April 1998. The water quality information was consistent with the existing shellfish growing water classification for SE-5. However, with the extension of the sewer lines from the Middle Township Sewage Authority it has allowed the Department to upgrade 74 acres of water from Prohibited to Seasonally Approved.

INTRODUCTION

PURPOSE

This report is part of a series of studies having a dual purpose. The first and primary purpose is to comply with the guidelines of the National Shellfish Sanitation Program (NSSP) that are established by the Interstate Shellfish Sanitation Conference (ISSC). Reports generated under this program form the basis for classifying shellfish waters for the purpose of harvesting shellfish for human consumption. As such, they provide a critical link in protecting human health.

The second purpose is to provide input to the State Water Quality Inventory Report, which is prepared pursuant to Section 305(b) of the Federal Clean Water Act (P.L. 95-217). The information contained in the growing area reports is used for the New Jersey State Water Quality Inventory Report (305b) which provides an assessment to Congress every two years of current water quality conditions in the State's major rivers, lakes, estuaries, and ocean waters. The reports provide valuable information for the 305(b) report, which describes the waters that are attaining state designated water uses and national clean water goals; the pollution problems identified in surface waters; and the actual or potential sources of pollution. Similarly, the reports utilize relevant information contained in the 305(b) report, since the latter assessments are based on instream monitoring data (temperature, oxygen, pH, total and fecal coliform bacteria, nutrients, solids, ammonia and metals), land-use profiles, drainage basin characteristics and other pollution source information.

From the perspective of the Shellfish Classification Program, the reciprocal use of water quality information from reports represent two sides of the same coin: the growing area report focuses on the estuary itself, while the 305(b) report describes the watershed that drains to that estuary.

The Department participates in a cooperative National Environmental Performance Partnership System (NEPPS) with the USEPA which emphasizes ongoing evaluation of issues associated with environmental regulation, including assessing impacts on waterbodies and measuring improvements in various indicators of environmental health. The shellfish growing area reports are intended to provide a brief assessment of the growing area, with particular emphasis on those factors that affect the quantity and quality of the shellfish resource. As the Department implements a comprehensive

watershed management program in conjunction with the NEPPS initiative, the shellfish growing area reports provide valuable information on the overall quality of the saline waters in the most downstream sections of each major watershed. In addition, the reports assess the quality of the biological resource and provide a reliable indicator of potential areas of concern and/or areas where additional information is needed to accurately assess watershed dynamics.

HISTORY

As a brief history, the NSSP developed from public health principles and program controls formulated at the original conference on shellfish sanitation called by the Surgeon General of the United States Public Health Service in 1925. This conference was called after oysters were implicated in causing over 1500 cases of typhoid fever and 150 deaths in 1924. The tripartite cooperative program (federal, state and shellfish industry) has updated the program procedures and guidelines through workshops held periodically until 1977. Because of concern by many states that the NSSP guidelines were not being enforced uniformly, a delegation of state shellfish officials from 22 states met in 1982 in Annapolis, Maryland, and formed the ISSC. The first annual meeting was held in 1983 and continues to meet annually at various locations throughout the United States.

Parts I and II of the NSSP Manual set forth the principles and requirements for the sanitary control of shellfish produced and shipped in interstate commerce in the United States. They provide basis used by the Federal Food and Drug Administration (FDA) in evaluating state shellfish sanitation programs. There are five major points on which the state is evaluated by the FDA include:

1. The classification of all actual and potential shellfish growing areas as to their suitability for shellfish harvesting.
2. The control of the harvesting of shellfish from areas that are classified as restricted prohibited or otherwise closed.
3. The regulation and supervision of shellfish resource recovery programs.
4. The ability to restrict the harvest of shellfish from areas in a public health emergency, and
5. Prevent the sale, shipment or possession of shellfish that cannot be identified as being produced in accordance with the NSSP and have the ability to condemn, seize or embargo such shellfish.

FUNCTIONAL AUTHORITY

The authority to carry out these functions is divided between the Department of Environmental Protection (DEP), the Department of Health and Senior Services and the Department of Law and Public Safety. The Bureau of Marine Water Monitoring (BMWM) under the authority of N.J.S.A. 58:24 classifies the shellfish growing waters and administers the special resource recovery programs. Regulations delineating the

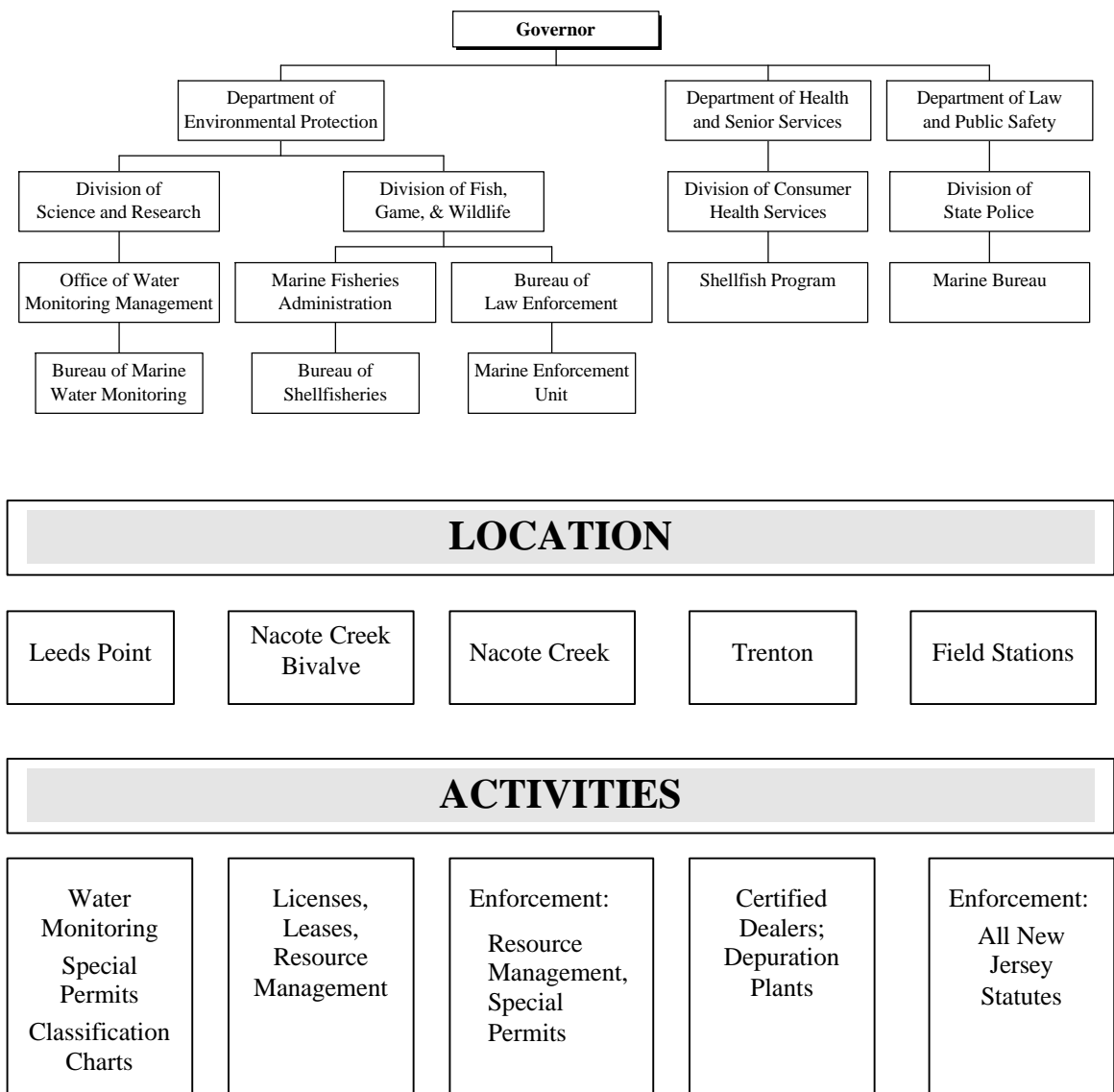
growing areas are promulgated at N.J.A.C. 7:12 and are revised annually. Special Permit rules are also found at N.J.A.C. 7:12 and are revised as necessary.

The Bureau of Shellfisheries in the Division of Fish, Game and Wildlife issues harvesting licenses and leases for shellfish grounds under the Authority of N.J.S.A. 50:2 and N.J.A.C. 7:25. This bureau in conjunction with the BMWM administers the Hard Clam Relay Program.

The Bureau of Law Enforcement in the DEP (Division of Fish, Game, and Wildlife) and the Division of State Police in the Department of Law and Public Safety enforce the provisions of the statutes and rules mentioned above.

The Department of Health Senior and Services is responsible for the certification of wholesale shellfish establishments and in conjunction with the BMWM, administers the depuration program.

Figure 1: STATE OF NEW JERSEY SHELLFISH AGENCIES



IMPORTANCE OF SANITARY CONTROL OF SHELLFISH

Emphasis is placed on the sanitary control of shellfish because of the direct relationship between pollution of shellfish growing areas and the transmission of diseases to humans. Shellfish borne infectious diseases are generally transmitted via a fecal-oral route. The pathway is complex and quite circuitous. The cycle usually begins with fecal contamination of the shellfish growing waters. Sources of such contamination are many and varied. Contamination reaches the waterways via runoff and direct discharges.

Clams, oysters and mussels pump large quantities of water through their bodies during the normal feeding process. During this process the shellfish also concentrate microorganisms, which may include pathogenic microbes, and toxic heavy metals/chemicals. It is imperative that a system is in place to reduce the human health risk of consuming shellfish from areas of contamination.

Accurate classifications of shellfish growing areas are completed through a comprehensive sanitary survey. The principal components of the sanitary survey report include:

1. An evaluation of all actual and potential sources of pollution,
2. An evaluation of the hydrography of the area and
3. An assessment of water quality. Complete intensive sanitary surveys are conducted every 12 years with interim narrative evaluations completed on a three-year basis. If major changes to the shoreline or bacterial quality occur, then the intensive report is initiated prior to its 12 year schedule.

The following narrative constitutes this bureau's assessment of the above mentioned components and determines the current classification of the shellfish growing waters.

DESCRIPTION

DESCRIPTION

Area SE-5 is located in Cape May County and includes waters draining to Hereford Inlet. This area can be found on chart 9 of the "State of New Jersey-Shellfish Growing Water Classification Charts". The principal water bodies in this area are Grassy Sound, Jenkins Sound, Great Sound, Richardson Sound and Hereford Inlet. There are also several thorofares and channels throughout area SE-5 such as Grassy Sound Channel, Jenkins Channel and Dung Thorofare. It is bordered by five municipalities: Avalon, Stone Harbor, North Wildwood, Wildwood and Middle Township. The statistics for these municipalities are shown below in Table I.

LOCATION

Figure 2: Location of Shellfish Growing Area SE-5

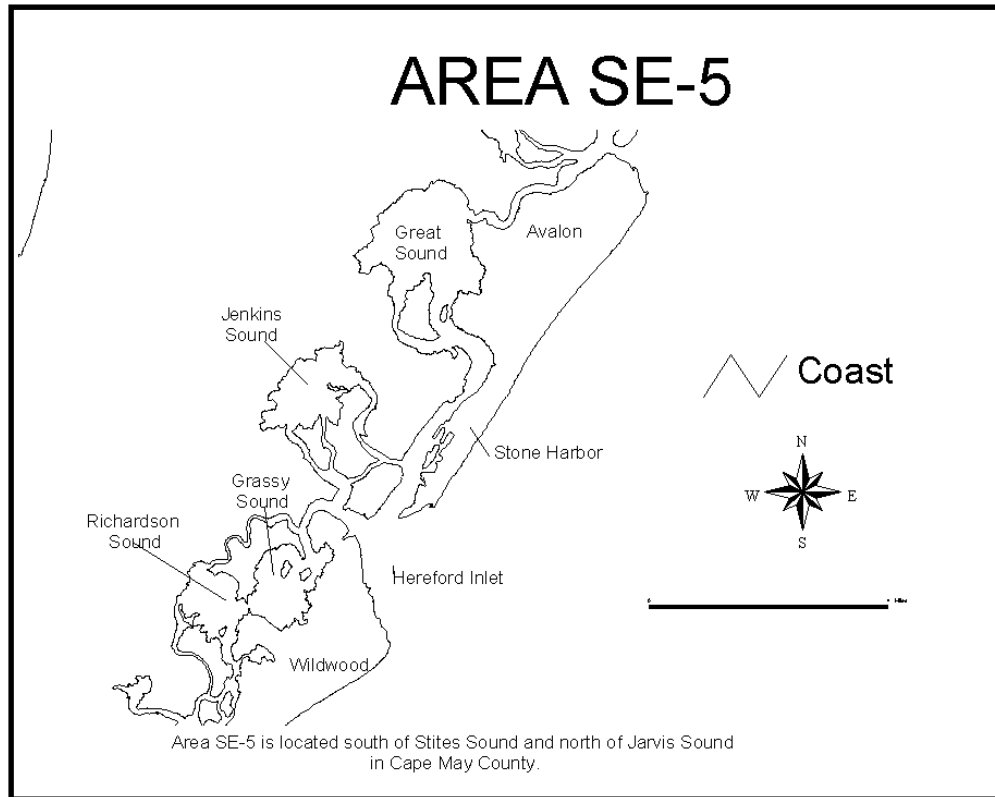
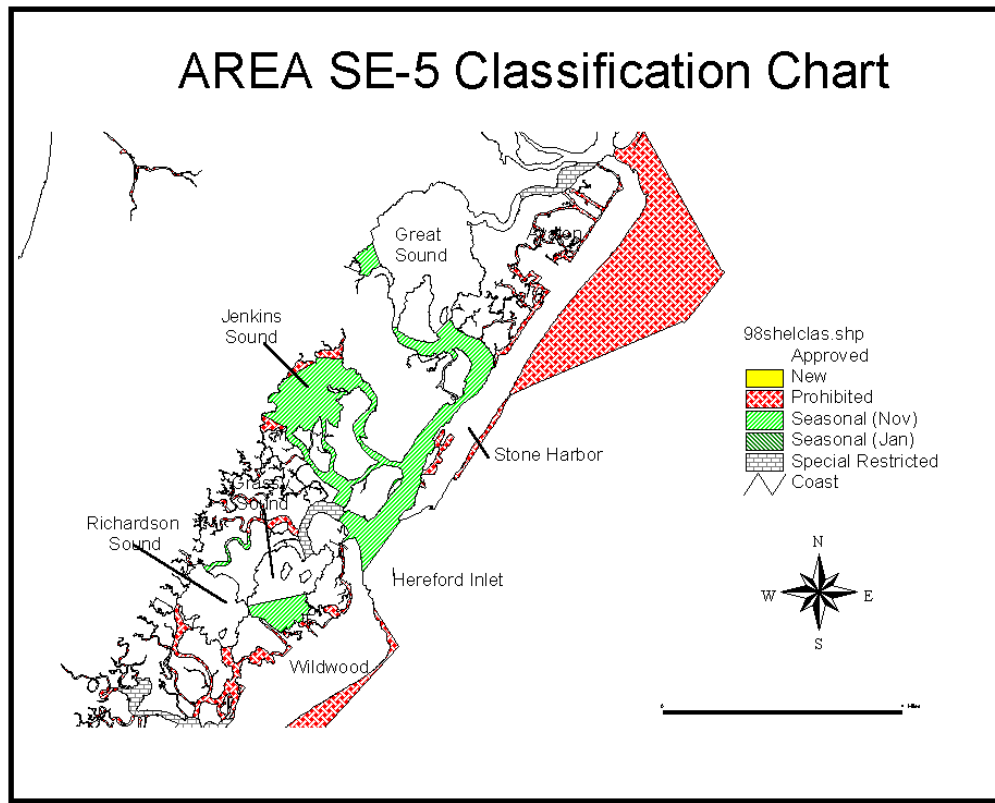


Table 1 : Summary of Population Statistics

Municipality	Population		Population Density(#/sq mi)		Area Square Miles
	Year-Round	Summer	Year-Round	Summer	
Avalon	1809	40,000	362	8,000	5.00 sq.mi
Stone Harbor	1025	25,000	780	17,730	1.41 sq.mi
North Wildwood	5013	75,000	3,133	46,875	1.60 sq.mi
Wildwood City	4484	125,000	1,794	50,000	2.50 sq.mi
Middle Township	14771	50,000	205	694	72.00 sq.mi

Figure 3 : Area SE-5 Classification



HISTORY OF AREA SE-5

The majority of area SE-5 is classified as Approved or Seasonally Approved. In the 1960's and 1970's much of the waters in this area were classified as Prohibited or Special Restricted. This was largely due to the wastewater discharges and poor septic systems. By 1990 much of the waters had been upgraded to Seasonally Approved as a direct result of the elimination of wastewater discharges into the area.

The last Sanitary Survey for area SE-5 was dated May 1993. A Reappraisal Report was done in September 1996, which covered data from January 1991 through December 1995.

METHODS

Water sampling was performed in accordance with the Field Procedures Manual (NJDEP, 1992).

Approximately 2238 water samples were collected for total and fecal coliform bacteria between 1995 and 1998 and analyzed by the three tube MPN method according to APHA (1970). Figure 4 shows the Shellfish Growing Water Quality monitoring stations in area SE-5. Approximately 109 stations total are monitored during each year in assignments 255 and 267.

Figure 4: Area SE-5 Sampling Stations – Great Sound & Jenkins Sound

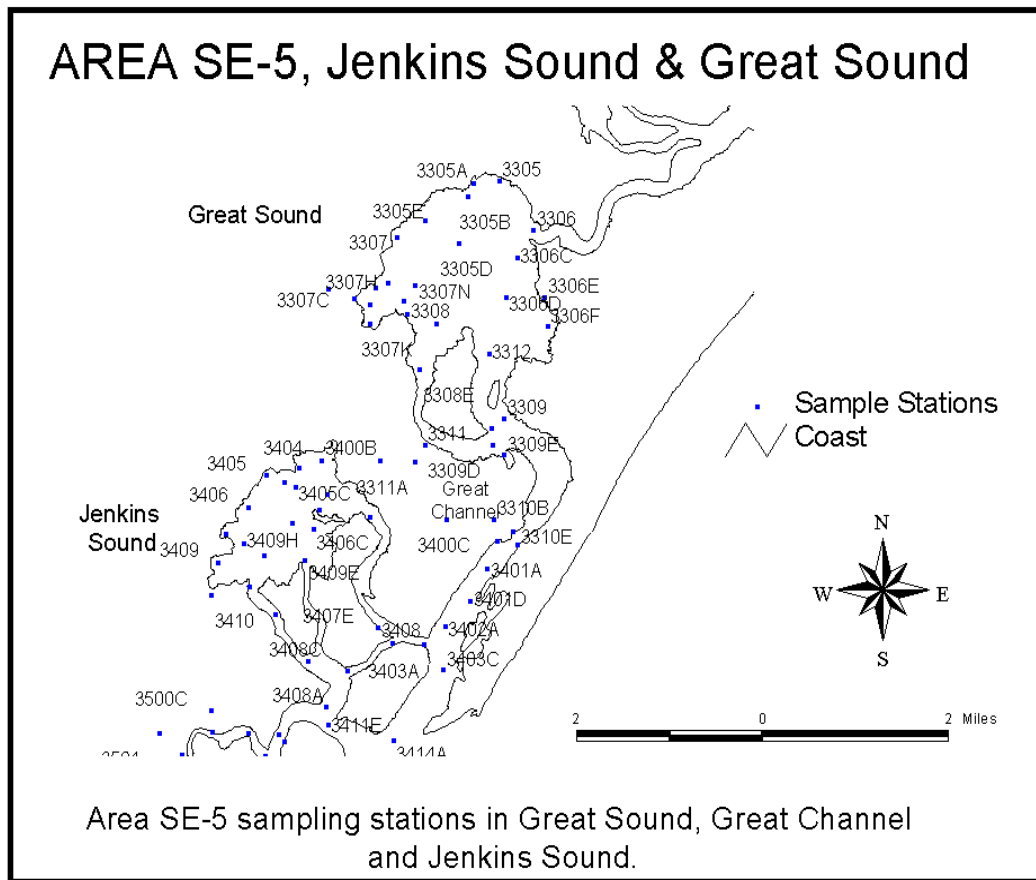
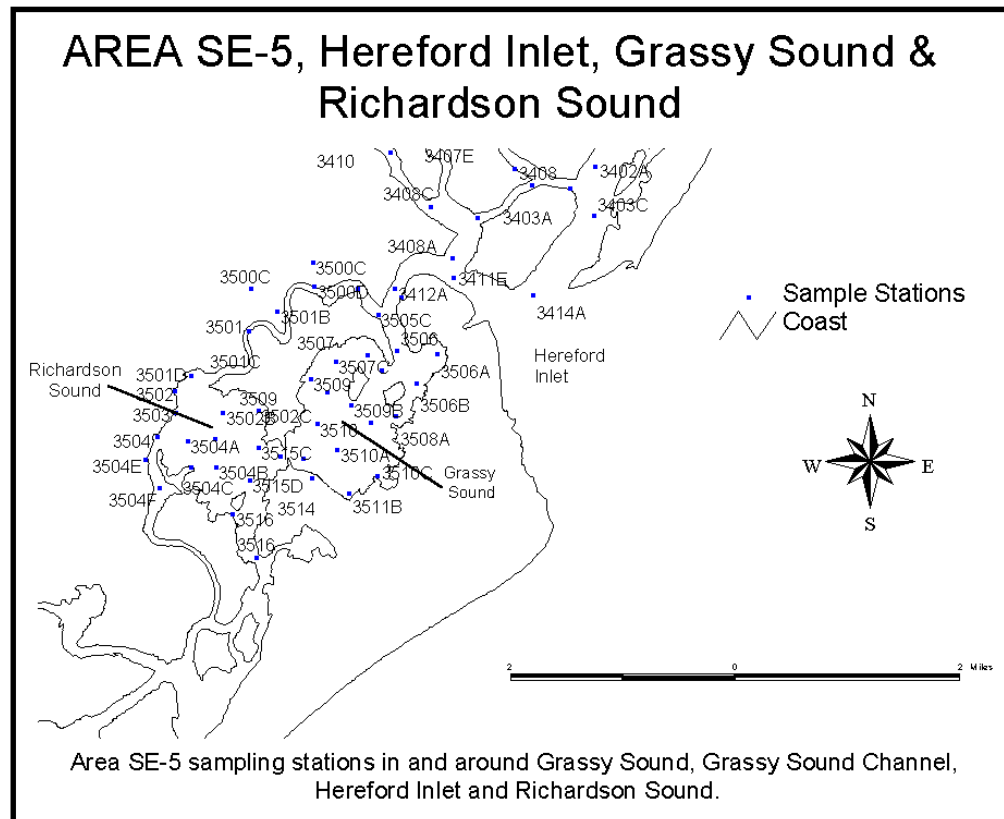


Figure 5: Area SE-5 Sampling Stations-Hereford Inlet, Grassy Sound & Richardson Sound



Water quality sampling, shoreline and watershed surveys were conducted in accordance with the NSSP Manual of Operations, Part I, Appendix B (USPHS, 1995).

Data management and analysis was accomplished using database applications developed for the Bureau. Mapping of pollution data was performed with the Geographic Information System (GIS:ARCVIEW).

BACTERIOLOGICAL INVESTIGATION AND DATA ANALYSIS

The water quality of each growing area must be evaluated before an area can be classified as *Approved*, *Seasonally Approved*, *Special Restricted*, or *Seasonal Special Restricted*. Criteria for bacterial acceptability of shellfish growing waters are provided in Part I of National Shellfish Sanitation Program Manual of Operations - 1995 Revision. Each shellfish producing state is directed to adopt either the total coliform criterion, or the fecal coliform criterion. While New Jersey bases its growing water classifications on the total coliform criterion, it does make corresponding fecal coliform determinations for each sampling station, these data are viewed as adjunct information and are not directly used for classification. The State Shellfish Control Authority also has the option of choosing one of the two water monitoring sampling strategies for each growing area.

The Adverse Pollution Condition Strategy requires that a minimum of five samples be collected each year under conditions that have historically resulted in elevated coliforms in the particular growing area. The results must be evaluated by adding the individual station sample results to the preexisting bacteriological sampling results to constitute a data set of at least 15 samples for each station. The adverse pollution conditions usually are related to tide, and rainfall, but could be from a point source of pollution or variation could occur during a specific time of the year. Under this strategy, for *Approved* waters, the total coliform median or geometric mean MPN of the water shall not exceed 70 per 100 mL and not more than 10 percent of the samples exceed an MPN of 330 per 100 mL for the 3-tube decimal dilution test. For *Special Restricted* waters, the total coliform median or geometric mean MPN of the water shall not exceed 700 per 100 mL and not more than 10 percent of the samples exceed an MPN of 3300 per 100 mL for the 3-tube decimal dilution test. Areas to be Approved under the Seasonal classification must be sampled and meet the criterion during the time of the year that it is approved for the harvest of shellfish.

The Systematic Random Sampling strategy requires that a random sampling plan be in place before field sampling begins and can only be used in areas that are not affected by point sources of contamination. A minimum of six samples per station are to be collected each year and added to database to obtain a sample size of 30 for statistical analysis. The bacteriological quality of every sampling station in *Approved* areas shall have a total coliform median or geometric mean MPN not exceeding 70 per 100 mL and the estimated 90th percentile shall not exceed an MPN of 330 per 100 mL. For *Special Restricted* areas, the bacteriological quality shall not exceed a total coliform median or geometric mean MPN of 700 per 100 mL and the estimated 90th percentile shall not exceed an MPN of 3,300 per 100 mL.

Area SE-5 was sampled using the Systematic Random Sampling strategy with an ebb tide preference for stations 3305 through 3411B, (Assignment 255). Stations 3411E through 3516B were sampled using the Adverse Pollution Condition strategy with no tidal preference, (Assignment 267).

MARINE BIOTOXINS

The Department collects samples at regular intervals throughout the summer to determine the occurrence of marine biotoxins. This data is evaluated weekly by the Bureau of Marine Water Monitoring in accordance with the NSSP requirements. An annual report is compiled by the Bureau of Freshwater and Biological Monitoring.

SHORELINE SURVEY

EVALUATION OF BIOLOGICAL RESOURCES

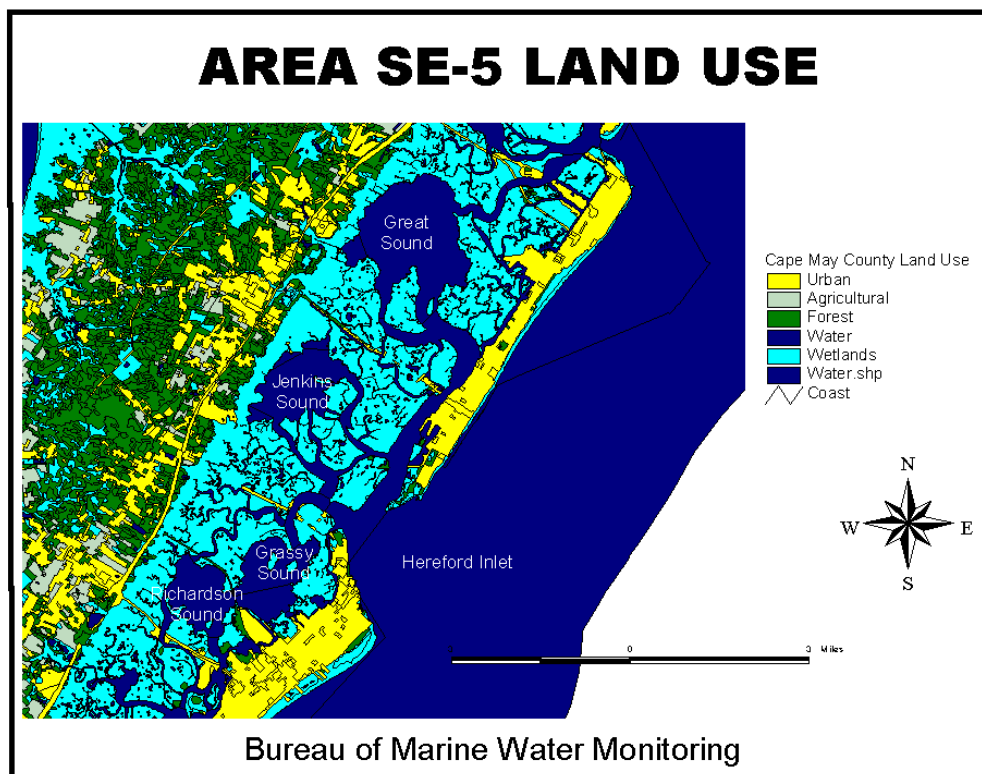
Area SE-5 is populated with hard clams (*Mercenaria mercenaria*) in a density of high commercial value.

LAND USE

There is little to no livestock farming in this area. The Cape May Zoo is located within the area of SE-5. The zoo is very efficient with its disposal of animal excrements. The animal cages are raked on a daily bases. The larger animals excrements are collected and disposed of in dumpsters which are emptied and taken to a landfill in Woodbine for disposal at least twice a week. There are three holding ponds at the entrance to the zoo which initially drain into Holmes creek and eventually into Great Sound. However, the zoo is located far enough inland that there is no impact to the shellfish waters at this time. Animals that require small pool have the water flushed and backwashed into ponds that are chlorinated and recirculated. The public bathrooms have their own septic system. There is a 35 acre forest that is basically preserved in its natural state. There is also an area of wetlands within this forest area. The zoo is very self contained and maintains a good balance of pest control without the use of pesticides

Area SE-5 is a resort area and there is significant boating activity during the summer. There are currently 20 marinas in the area. The majority of the area surrounding the waterways in SE-5 are urban areas and wetlands, (see figure 6).

Figure 6: Area SE-5 Land Use



CHANGES SINCE LAST SURVEY

An area of SE-5 located along Stone Harbor Boulevard, and approximately 165 homes in Stone Harbor Manor were connected to the public collection system in late 1991. The waters located around Stone Harbor Blvd., Crooked Creek, Stone Harbor Canal and Scotch Bonnet, are classified as Prohibited and will remain as such due to the boat activity in the area. Additionally, a community along the western shore of Jenkins Sound with about 12 homes (Benny's Landing) was connected to the public collection system in 1995. The last report did not have enough data to evaluate this area since the connection to the public sewer. However, after reviewing the current data, water quality has improved to allow the upgrading of 74 acres of water in Jenkins Sound from Prohibited to Seasonally Approved

IDENTIFICATION AND EVALUATION OF SOURCES

Marinas

Marina facilities have the potential to affect the suitability of shellfish growing areas for the harvest of shellfish. The biological and chemical contamination associated with marina facilities may be of public health significance. New Jersey defines a marina as "any structure (docks, piers, bulkheads, floating docks, etc.) that supports five or more boats, built on or near the water, which is utilized for docking, storing, or otherwise mooring vessels and usually but not necessarily provides services to vessels such as repairing, fueling, security or other related activities" and designates the confines of the marina as *Prohibited* for the harvest of shellfish. Adjacent waters are classified using a dilution analysis formula.

It is recognized by the National Shellfish Sanitation Program, Manual of Operations, Part1, Section C-9, that there are significant regional differences in all factors that affect marina pollutant loading. The manual therefore allows each state latitude in applying specified occupancy and discharge rates. The NSSP guidelines assume the worst case scenario for each factor.

There are 20 marinas in area SE-5, as shown in Table 2 and Figure 7. The waters enclosed by the marina are classified as *Prohibited*; depending on the size of the marina and the water quality, water immediately adjacent to each marina may be classified as *Prohibited*, *Special Restricted*, or *Seasonally Approved* (no harvest during summer months when the marina is active). Marina buffer zones were calculated using the formula below. When a marina has no slips that can handle a boat that is 24 feet or larger, a standard buffer radius of 100 ft. is designated. The size of each buffer zone is shown in Table 2.

Table 2 : Marinas in Area SE-5.

Marina Name		Wet slips Total/Boats >24ft	Location	Buffer Radius(ft)	Depth (ft)
1	Hereford Inlet Marina	102/102	North Wildwood	1168	6
2	B & E 26 th St. Marina	75/75	Wildwood	1002	6
3	Spray Dock Marina	12/0	Wildwood	100	6
4	Hayes Waterway Marina	25/10	Wildwood	270	11
5	Grassy Sound Marina	57/10	North Wildwood	82	12
6	Pier 47 Marina	80/6	Wildwood	310	5
7	Starcrest Marina	10/1	Wildwood	116	6
8	Lighthouse Point Marina	165/165	Wildwood	1010	13
9	Gallo's Marina	30/0	Wildwood	100	6
10	West Bay Marina	36/0	Wildwood	100	6
11	Dad's Place Marina	0/0	North Wildwood	100	6
12	Bayfront Boat Basin	120/120	North Wildwood	1267	6
13	Ed's Canal Boat Rental	8/0	North Wildwood	100	6
14	Shawcrest Marina	99/99	Wildwood	782	13
15	Dino's Marina	10/2	Wildwood	164	6
16	Smugglers Cove Boat Rental	0/0	Stone Harbor	100	24
17	Stone Harbor Municipal Marina	80/80	Stone Harbor	654	15
18	Camp Marine Services	30/30	Stone Harbor	430	13
19	54 th & Bay Park Marina	30/30	Stone Harbor	317	24
20	Stone Harbor Marina	170/126	Stone Harbor	651	24

New Jersey Marina Buffer Equation.:

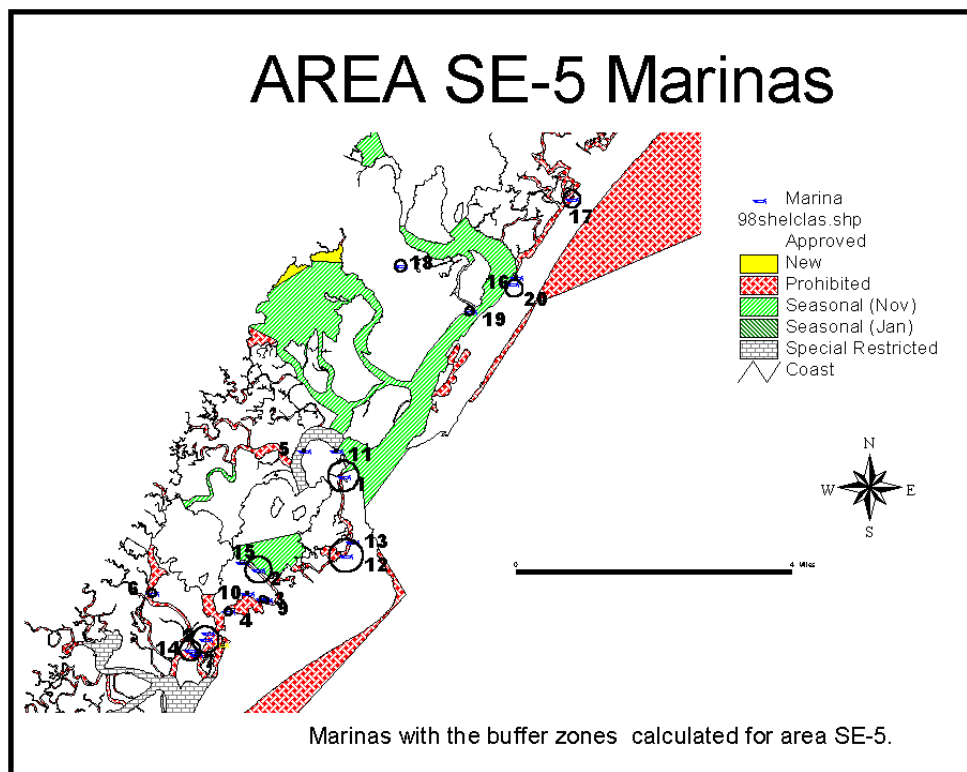
$$BufferRadius(ft) = \sqrt{\frac{2 \times 10^9 (FC / person / day) \times 2 (person / boat) \times (.25 slips) \times 2}{140000 (FC / M^3) \times depth(ft) \times 0.3048 (M / ft) \times 2 (tides / day)}} \times 3.28 (ft / M)$$

Explanation of terms in equation:

Fecal coliform per person per day:	2×10^9
Number of people per boat:	2
Number of slips occupied:	50% (only those able to accommodate a boat > 24 feet in length)
Number of boats occupied:	50%
Angle of shoreline:	180°, which results in factor of 2
Number of tides per day:	2
Depth in meters:	depth in feet x conversion factor
Water quality to be achieved:	140000 FC/meter ³
Buffer in feet:	convert meters to feet using conversion factor

Marina buffer zones may be calculated using the formula above, or may be determined using a dilution analysis computer program developed by the State of Virginia and the USFDA. The computer program is used for complex configurations where the formula is unlikely to provide the needed accuracy.

Figure 7: Marinas, Showing Buffer Zones Surrounding Marinas.



HYDROGRAPHY AND METEOROLOGY

Area SE-5 is bordered primarily by marsh to the north and west and by intense development to the south and east. It consists of four main water bodies, Great Sound (1720 acres), Jenkins Sound (870 acres), Grassy Sound (741 acres) and Richardson Sound (637 acres). The waters in these bays are relatively shallow with depths averaging 1-2 feet (MLW). The water depths in the Great Channel and the Intracoastal Waterway average from 15 to 20 feet. The tides in this area are diurnal, (twice/day), with an average range of 4 feet. Most of the tidal exchange is through Hereford Inlet. There are no major fresh water influences in the area.

Precipitation inputs to the area for the period 1995 through 1998 are shown in the Climatological Data table. The primary weather station for this area is Cape May. The secondary weather station for this area is Millville. The secondary station data is used when data from the primary station is incomplete.

Table 3 : Climatological Data

Rainfall Recorded at NOAA's **Cape May Station**
at 1200 hrs; Wind and Temperature aboard sampling
vessel at time of sample collection

Sampling Date	Precipitation in Inches			
	Sampling day	1 day prior	2 days prior	3 days prior
03/17/95	0.000	0.000	0.000	0.000
04/11/95	0.010	0.110	0.210	0.210
04/12/95	0.140	0.150	0.250	0.350
04/18/95	0.000	0.000	0.000	0.000
04/20/95	0.000	0.000	0.000	0.000
04/21/95	0.000	0.000	0.000	0.000
04/25/95	0.000	0.700	0.710	0.720
04/26/95	0.000	0.000	0.700	0.710
04/28/95	0.020	0.020	0.020	0.020
05/05/95	0.280	0.280	0.280	1.130
07/06/95	0.120	0.120	0.120	0.120
07/14/95	0.000	0.000	0.000	0.260
07/19/95	0.000	0.250	0.250	0.260
07/31/95	0.000	0.000	0.000	0.010
08/01/95	0.000	0.000	0.000	0.000
08/22/95	0.000	0.000	0.000	0.000
09/11/95	0.000	0.520	0.550	0.550
09/26/95	0.290	0.690	0.690	0.710
10/11/95	0.000	0.000	0.000	0.000
10/20/95	0.250	0.250	0.250	0.250
12/06/95	0.060	0.230	0.230	0.230
12/15/95	0.000	0.040	0.040	0.040
02/22/96	0.170	0.290	0.450	0.450
03/05/96	0.020	0.020	0.020	0.510
03/07/96	0.570	0.830	0.850	0.850
03/20/96	0.000	0.280	0.280	0.280
03/21/96	0.000	0.000	0.280	0.280

Sampling Date	Precipitation in Inches			
	Sampling day	1 day prior	2 days prior	3 days prior
03/26/96	0.000	0.000	0.000	0.000
06/25/96	0.100	0.370	0.370	0.370
07/24/96	0.000	0.010	0.040	0.040
07/30/96	0.050	0.050	0.050	0.050
09/12/96	2.710	3.660	3.660	3.660
09/18/96	0.050	1.050	2.090	2.090
10/01/96	0.000	0.000	0.350	0.650
10/03/96	0.000	0.000	0.000	0.000
10/28/96	0.100	0.100	0.100	0.100
12/09/96	0.020	0.020	1.430	1.930
12/12/96	0.140	0.170	0.170	0.190
01/10/97	0.000	0.610	0.610	0.610
01/27/97	0.000	0.000	0.240	0.270
02/04/97	0.290	0.290	0.310	0.330
02/20/97	0.000	0.000	0.000	0.000
03/04/97	0.000	0.930	0.930	1.220
03/19/97	0.430	0.560	0.560	0.560
03/21/97	0.000	0.000	0.430	0.560
04/04/97	0.000	0.000	0.000	0.050
04/17/97	0.190	0.190	0.190	0.190
06/23/97	0.000	0.000	0.000	0.000
06/26/97	0.400	0.400	0.400	0.400
07/23/97	0.160	0.220	0.220	0.220
09/17/97	0.000	0.000	0.000	0.000
09/18/97	0.000	0.000	0.000	0.000
10/02/97	0.000	0.000	0.000	0.005
10/03/97	0.000	0.000	0.000	0.000
10/06/97	0.000	0.000	0.000	0.000
11/03/97	0.000	0.090	0.920	0.920
11/18/97	0.000	0.000	0.010	0.050
12/04/97	0.550	0.550	0.550	0.550
12/11/97	0.010	0.440	0.440	0.440

WATER QUALITY STUDIES

BACTERIOLOGICAL QUALITY

The raw data listings and statistical summaries according to National Shellfish Sanitation Program (NSSP) criteria are given in the appendix. There were no stations that exceeded the NSSP criteria applicable to the classification of each area.

INTERPETATION AND DISCUSSION OF DATA

BACTERIOLOGICAL

Criteria for bacterial acceptability of shellfish growing waters are provided in Part I of the National Shellfish Sanitation Program's Manual of Operations, 1995 Revisions. Each shellfish producing state is directed to adopt either the total coliform or the fecal coliform criteria for growing water classifications. Historically, New Jersey based growing water classifications on the total coliform criteria and is using these criteria currently.

The total coliform median or geometric mean MPN (most probable number) does not exceed 70 per 100 mL and not more than 10% of the samples exceed an MPN of 330 per 100mL where the three tube decimal dilution test. The total coliform standard need not be applied if it can be shown by detailed study verified by laboratory findings that the coliforms are not of direct fecal origin and do not indicate a public health hazard.

While New Jersey does make corresponding fecal coliform determinations for each total coliform determination, this data is viewed as adjunct information and is not directly used for classification.

Based on the water quality data collected no stations showed a significant tidal component. It had previously been determined that the adverse condition for a portion of area SE-5 located in and around Hereford Inlet, Great Sound and Jenkins Sound was during the Ebb tide. Therefore, this area was monitored under an Ebb tide preference for this time period. Although the water quality data collected showed that this area was still in compliance with the existing classification, we were unable to evaluate the ebb vs. flood tide data. This was due to the lack of data collected during flood tide conditions. With the increase in staff, we will be able to collect additional runs, (during flood tide conditions), which will allow the evaluation of ebb and flood tide conditions. The portion of SE-5 in and around Grassy Sound and Richardson Sound had data collected during ebb and flood tide. However, the stations in this area showed no tidal effect.

A significant correlation to rainfall was found to occur at 15 out of 109 of the stations sampled in area SE-5, (13% of stations sampled). There were 11 stations that showed a correlation on the day of sampling, as well as one and two days prior to sampling. Three stations, (3405C, 3412A, 3510A), showed a correlation only on the day of sampling and one station, (3502), showed a correlation only at one day prior to sampling, (see Figure 8).

The majority of the stations with a correlation to rainfall were located in and around Great Sound. This is an area that is classified as Approved and Seasonally Approved waters. In spite of the correlation to rainfall the total and fecal coliform levels are very low. It is not necessary to classify this area as a rainfall priority area, (see Table 4 and Figure 8).

Figure 8: Rainfall Correlation (0 to 48hrs)

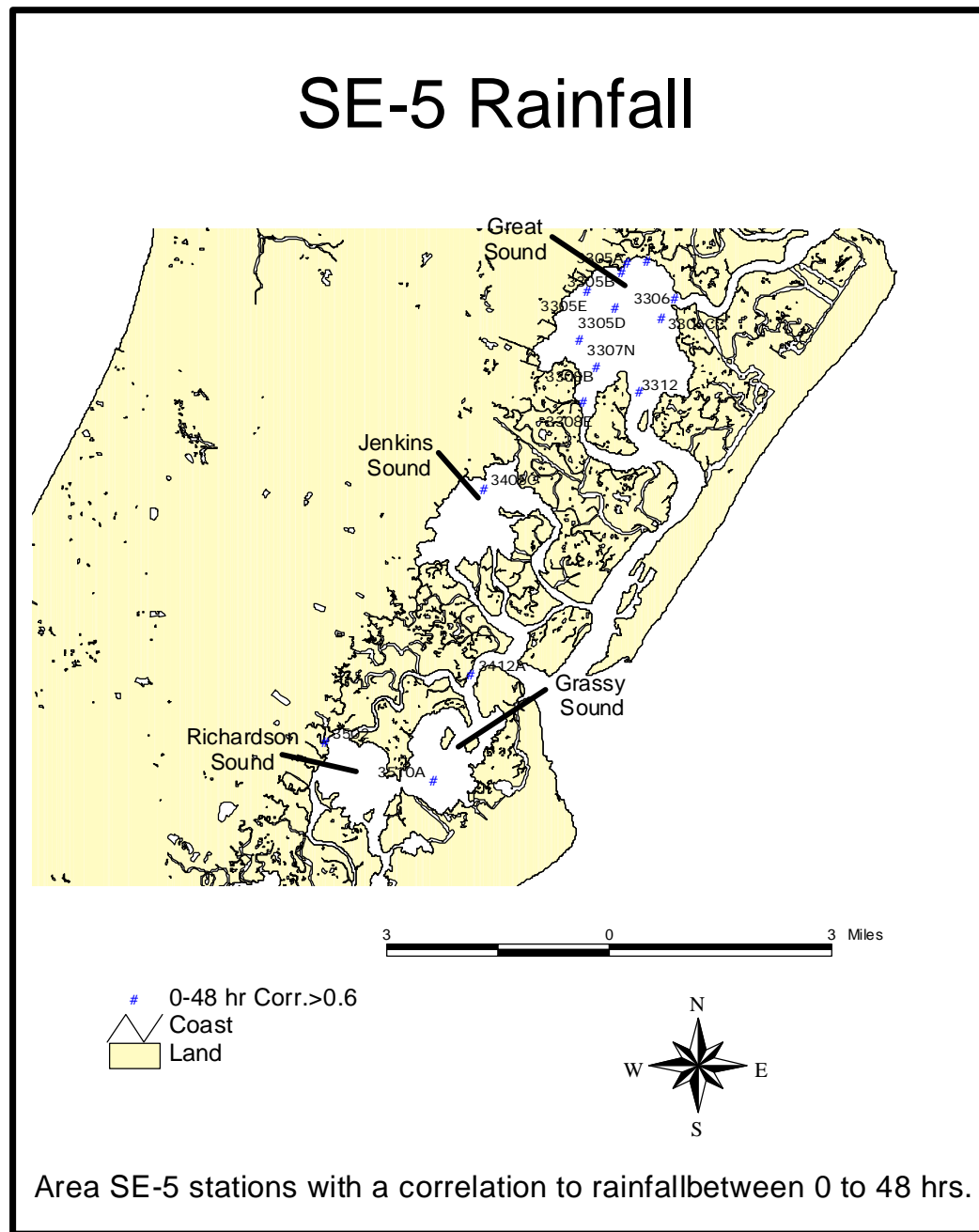


Table 4: Correlation of total coliform MPN values with cumulative rainfall.

Station	Correlation of total coliform with rainfall			Number of Observations
	Day of Sampling	24 hours prior	48 hours prior	
3305	0.860	0.7773	0.7823	13
3305A	0.8600	0.8912	0.8909	13
3305B	0.8797	0.8612	0.8427	13
3305D	0.6746	0.6416	0.6055	13
3305E	0.9353	0.9191	0.9110	13
3306	0.8373	0.8201	0.8085	13
3306C	0.6559	0.7559	0.7415	13
3307N	0.7044	0.6720	0.6427	13
3308B	0.8468	0.8269	0.8035	13
3308E	0.7364	0.7557	0.7570	13
3312	0.8243	0.8194	0.8198	13
3405C	0.6169	0.4380	0.5101	19
3412A	0.6676	0.2555	0.1551	24
3502	0.2524	0.6704	0.4973	24
3510A	0.7004	0.2193	0.1634	24

A portion of area SE-5, which included stations 3305 through 3411B, was only sampled during the winter. As a result, there was little or no data available during the summer months to evaluate a seasonal effect. The remaining area of SE-5, which covered stations 3411E through 3516B, was sampled year-round. In this area there was only one station in area SE-5 that showed a significant seasonal component of water quality. This station showed a higher total coliform geometric mean during the summer than during the winter. (see table 5 below).

Table 5: Summer versus Winter Conditions.

T-test comparing total coliform MPN values under summer versus winter conditions.

Station ¹	Geometric Mean Total Coliform MPN		Prob>[T] ²
	Summer	Winter	
3507A	12.9	3.8	0.05107

CONCLUSIONS

BACTERIOLOGICAL EVALUATION

Water quality in Area SE-5 is generally good with all of the stations meeting the NSSP total coliform criteria for the applicable classification.

There is an area in Jenkins Sound known as Bennys Landing that has been connected to the Middle Township Sewage Authority since the last sanitary survey. This area previously had homes that were operating with failing septs. As a result of the failing septs, portions of Jenkins Sound had been classified as Prohibited waters. Since this area is now sewered the waters in this area can be upgraded to Seasonal waters. Additionally the same situation prevails in the area of Jenkins Sound known as Genesis Bay. This area will also be upgraded from Prohibited to Seasonal waters. The water quality in both areas has been very good and meets the criteria for Seasonally Approved waters. There is a possibility that these waters may be upgraded to Approved waters in the future. However, at this time the existing data was collected during the winter months. In order to consider upgrading these waters to approved status the sampling strategy must be changed from winter only to year-round sampling. This will provide summer data for evaluation.

RECOMMENDATIONS

BACTERIOLOGICAL EVALUATION

1. Classification Change

The present classification for the waters in Bennys Landing and Genesis Bay can be seen in **Figure 9, Present Classification of Jenkins Sound**. The recommended change allows 74 acres of Prohibited waters to be upgraded to Seasonally Approved waters. (See **Figure10, Proposed Classification change in Jenkins Sound**.) This change would require N.J.A.C. 7:12-2.1(a)15, to be modified as follows.

¹ Only stations showing significant differences are listed.

² T-test significance level (probability of a greater T statistic with equal means).

i.[All of Jenkins Sound north of a line from a Department maintained marker northeast of a parking area at Shellbed Landing and bearing approximately 078 degrees T to another Department maintained marker and terminating; and] All of Shellbed Creek.

ii. [All of Genesis Bay north of a line defined by two Department maintained markers outside the mouth of Hetty Creek.] All of Slab Creek.

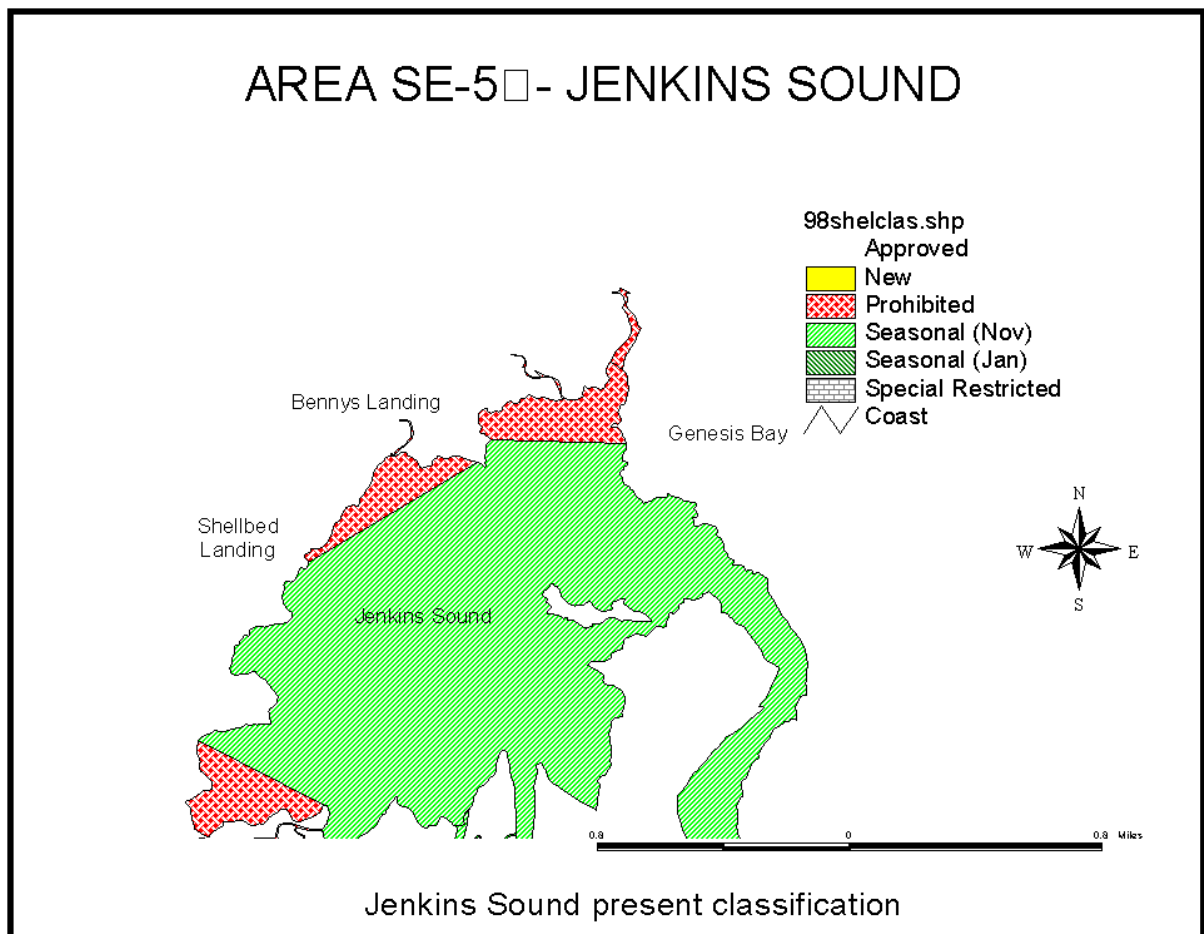
iii. All of Back Creek.

iv. All of Charles Creek.

v. All of Josh Creek.

Figure 9: Present Classification of Jenkins Sound

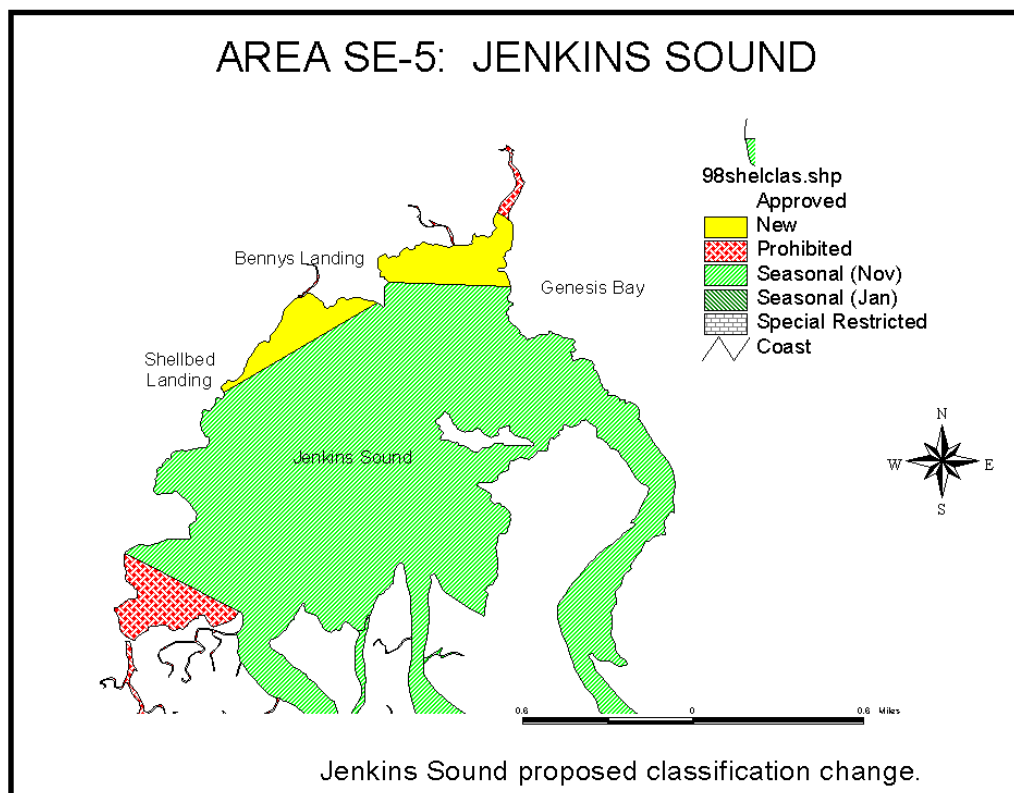
This recommendation would also require N.J.A.C. 7:12-4.1(a)11I to be modified as follows.



i. All of Nichols Channel, Dung Thoro, Great Flat Thoro, Drum Thoro, Jenkins Channel, Genesis Bay, Jenkins Sound and tributaries thereof contained within a

line beginning at the parking area at Shellbed Landing and continuing along the Jenkins Sound shoreline in a southwesterly direction to a Department maintained marker at the mouth of an unnamed tributary to Race Cove, then bearing approximately 126 degrees T to another Department maintained marker, then in a southeasterly direction along the Jenkins Channel shoreline excluding tributaries to Dead Thoro Point, then in a southwesterly direction to Grassy Sound Channel, then bearing approximately 118 degrees T to Nummy Island, then along that shoreline in a northeasterly direction including tributaries to Great Channel, then bearing approximately 013 degrees T to the opposite shoreline, then along the shoreline of Dung Thoro and Nichols Channel, excluding tributaries to a Department maintained marker on the shoreline of Genesis Bay, then [bearing approximately 279 degrees T to a Department maintained marker,] along the shoreline of Genesis Bay excluding Hetty Creek, Josh Creek, Charles Creek and Back Creek to Gunners Point, then continuing along the shoreline in a [southerly] southwesterly direction [to a Department maintained marker, then bearing approximately 258 degrees T to a Department maintained marker, then along the shoreline in a southwesterly direction] excluding all tributaries, to the point of origin and terminating.

Figure 10: Proposed Classification Change in Jenkins Sound



2. Sampling Regime Change

Assignment 255, Hereford Inlet and Jenkins Sound, is sampled under the Systematic Random Sampling strategy and should continue as such. However, it is recommended that five additional runs be collected in assignment 255 to cover yearround sampling. This would allow for a better evaluation of the water quality under summer conditions and the possible future upgrade of existing seasonal waters. It is also recommended that the ebb tide preference requirement be removed to allow samples to be taken on both ebb and flood tide. This would allow for a better evaluation of tidal conditions. Assignment 267, Richardson Sound and Grassy Sound, is sampled under the Adverse Pollution Control strategy and should continue as such. However, it is recommended that two additional runs be collected in the summer to allow for a better evaluation of summer conditions.

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APPENDICES

Appendices noted in this report are **not** available for download.